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PHYSICAL SCIENCE

物理科学

Machines Make It Move 机械运动

STEPHEN M. TOMECEK (美) 著

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物理科学

机械运动

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如果你希望读到地道的英语，在享受英语阅读乐趣的同时又能增长知识、开拓视野，这套由外语教学与研究出版社与美国国家地理学会合作出版的“国家地理科学探索丛书”正是你的选择。

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这套丛书以英文注释形式出版，注释由国内重点中学教学经验丰富的英语教师完成。特别值得推荐的是本套丛书在提高青少年读者英语阅读能力的同时，还注重培养他们的科学探索精神、动手能力、逻辑思维能力和沟通能力。

本丛书既适合学生自学，又可用于课堂教学。丛书各个系列均配有一本教师用书，内容包括背景知识介绍、技能训练提示、评估测试、多项选择题及答案等详尽的教学指导，是对课堂教学的极好补充。

本套丛书是适合中学生及英语爱好者的知识读物。



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A Marvelous Move

了不起的移动

The great moai¹, or stone statues², of Easter Island³ stand guard by the Pacific Ocean⁴. Tall and massive⁵, they have stood for centuries. How did they get there?

- | | | |
|------------------|------|-----------|
| 1. moai | n. | 摩埃(石像) |
| 2. statue | n. | 雕像 |
| 3. Easter Island | | 复活节岛 |
| 4. Pacific Ocean | | 太平洋 |
| 5. massive | adj. | 巨大的; 大而重的 |

Since Dutch¹ explorers² first saw the moai in 1772, the world has marveled³ at the huge statues. How were they moved to their positions⁴ near the ocean? In 1955 a scientist named Thor Heyerdahl tried to find out.

Heyerdahl lived with the Rapa Nui⁵ people of Easter Island, and eventually⁶ the islanders⁷ revealed⁸ the secret of the moai. They said the statues had been raised using rocks and long wooden poles⁹ cut from tree trunks¹⁰. The islanders showed Heyerdahl how a statue could be raised using ropes and two wooden poles as simple machines¹¹ called levers¹². Each time the crew¹³ raised the statue a little, they piled¹⁴ rocks underneath¹⁵ to hold it up. After 18 days, the 12 islanders had the statue standing up straight¹⁶.

In this book we'll look at how simple machines were used in the past and how we use them often in our lives today.

1. Dutch	<i>adj.</i>	荷兰的	10. trunk	<i>n.</i>	树干
2. explorer	<i>n.</i>	探险者; 探索者	11. simple machine		简单机械
3. marvel	<i>v.</i>	惊奇	12. lever	<i>n.</i>	杠杆
4. position	<i>n.</i>	位置	13. crew	<i>n.</i>	一队工作人员
5. Rapa Nui		拉帕努依岛(复活节岛)	14. pile	<i>v.</i>	堆积
6. eventually	<i>adv.</i>	最后; 终于	15. underneath	<i>adv.</i>	在下面; 在底下
7. islander	<i>n.</i>	岛上居民	16. straight	<i>adv.</i>	直立地
8. reveal	<i>v.</i>	揭示; 披露	17. demonstrate	<i>v.</i>	展示; 示范
9. pole	<i>n.</i>	杆; 柱			

Islanders demonstrate¹⁷
how statues could have
been raised long ago.



Machines at Work:

A World of Machines

机器在运转：机械世界

When you hear the word machine, what's the first thing that comes to mind? A giant bulldozer¹ or a crane²? A bicycle? Today our world is filled with many types of machines that help us get work done.

1. bulldozer
2. crane

n.
n.

推土机
起重机

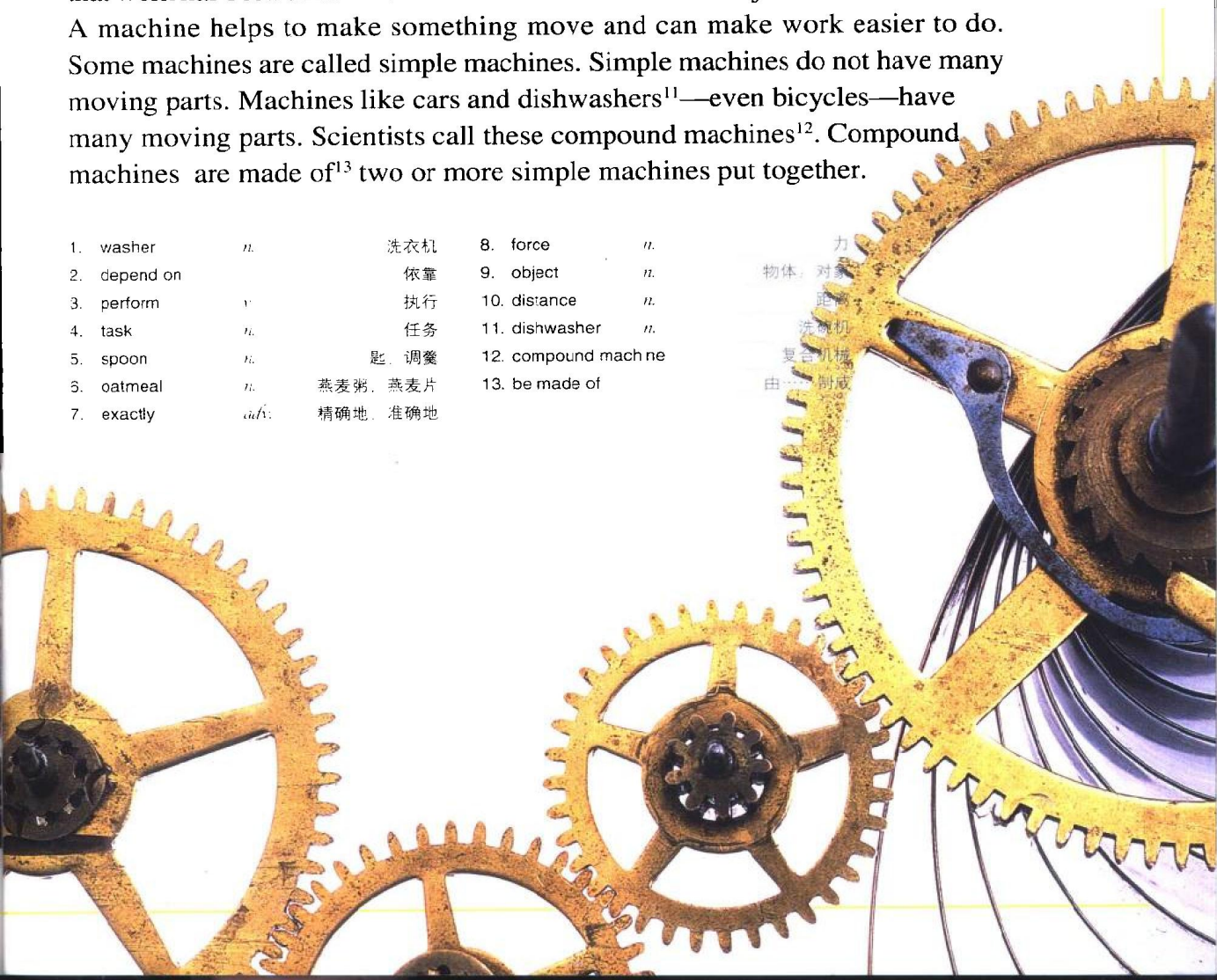


Our lives would be very different without machines. They're everywhere! From the washer¹ that cleans your clothes to the bus that takes you to school, we depend on² machines for many things. To perform³ the many tasks⁴ they do, machines come in many forms. Some machines, such as a bulldozer or bicycle, have many moving parts. Others are so simple you probably don't even think of them as machines. A spoon⁵ is nothing but a stick with a little bowl on it. Yet in your hand it becomes a machine. Just try eating a bowl of hot oatmeal⁶ without one!

What Exactly⁷ Are Machines?

In simple terms, a machine is anything that helps you do work. Scientists say that work has been done when a force⁸ is used to move an object⁹ over a distance¹⁰. A machine helps to make something move and can make work easier to do. Some machines are called simple machines. Simple machines do not have many moving parts. Machines like cars and dishwashers¹¹—even bicycles—have many moving parts. Scientists call these compound machines¹². Compound machines are made of¹³ two or more simple machines put together.

- | | | | | | |
|--------------|-------------|----------|----------------------|-----------|--------|
| 1. washer | <i>n.</i> | 洗衣机 | 8. force | <i>n.</i> | 力 |
| 2. depend on | | 依靠 | 9. object | <i>n.</i> | 物体, 对象 |
| 3. perform | <i>v.</i> | 执行 | 10. distance | <i>n.</i> | 距离 |
| 4. task | <i>n.</i> | 任务 | 11. dishwasher | <i>n.</i> | 洗碗机 |
| 5. spoon | <i>n.</i> | 匙, 调羹 | 12. compound machine | | 复合机械 |
| 6. oatmeal | <i>n.</i> | 燕麦粥, 燕麦片 | 13. be made of | | 由...制成 |
| 7. exactly | <i>adv.</i> | 精确地, 准确地 | | | |



Six Simple Machines

There are six different types of simple machines: the wedge¹, the lever, the inclined plane² or ramp³, the screw⁴, the wheel and axle⁵, and the pulley⁶. While they will get work done in different ways, all simple machines do at least one of the following things:

- increase the speed of an object.
- increase the force that you can use.
- change the direction of a force.

Many machines do several⁷ different things. A hammer⁸, which is a type of lever, lets you increase⁹ the force you use to drive a nail into a board. A hammer can also let you change the direction of a force, such as when you push down on the handle¹⁰ to pull a nail out of a board with the claw¹¹ of the hammer.

How can simple machines help you do work?

The First Machines

No one knows when the first machine was invented, but archaeologists¹² have found examples of stone tools dating to more than two million years ago. These tools were used mostly for cutting, scraping¹³, and chopping¹⁴. They are examples of one type of simple

machine, the wedge.

Wedges—Splitting¹⁵ It Up

Wedges come in two basic varieties¹⁶: broad¹⁷ and flat like the head of an ax¹⁸, or round and pointed¹⁹ like the tip of an arrow. Early humans probably didn't invent wedges but used naturally pointed sticks and stones. Eventually people learned how to make their own wedges by shaping rocks and sticks. They were even able to make knives as sharp as most modern-day blades²⁰.

1. wedge	n.	楔
2. inclined plane		斜面
3. ramp	n.	斜面
4. screw	n.	螺杆; 螺钉
5. axle	n.	(轮)轴; 车轴
6. pulley	n.	滑轮; 滑车
7. several	adj.	几个的
8. hammer	n.	锤子
9. increase	v.	增加
10. handle	n.	柄; 把手
11. claw	n.	爪状物; 爪形器具
12. archaeologist	n.	考古学家
13. scrape	v.	刮; 擦
14. chop	v.	砍; 劈
15. split	v.	劈开; 使分离
16. variety	n.	种类
17. broad	adj.	宽的
18. ax	n.	斧子
19. pointed	adj.	尖的
20. blade	n.	刀刃; 刀片
21. Latin	adj.	拉丁语的
22. device	n.	设备; 装置
23. complex	adj.	复杂的
24. rocket	n.	火箭
25. energy	n.	能量

Word Power

The word **machine** comes from the Latin²¹ word **machina**. The word **machine** can be used to describe simple devices²², such as wedges, as well as very complex²³ inventions, such as cars and rockets²⁴. All machines use energy²⁵ to do work.



Head of an ancient ax



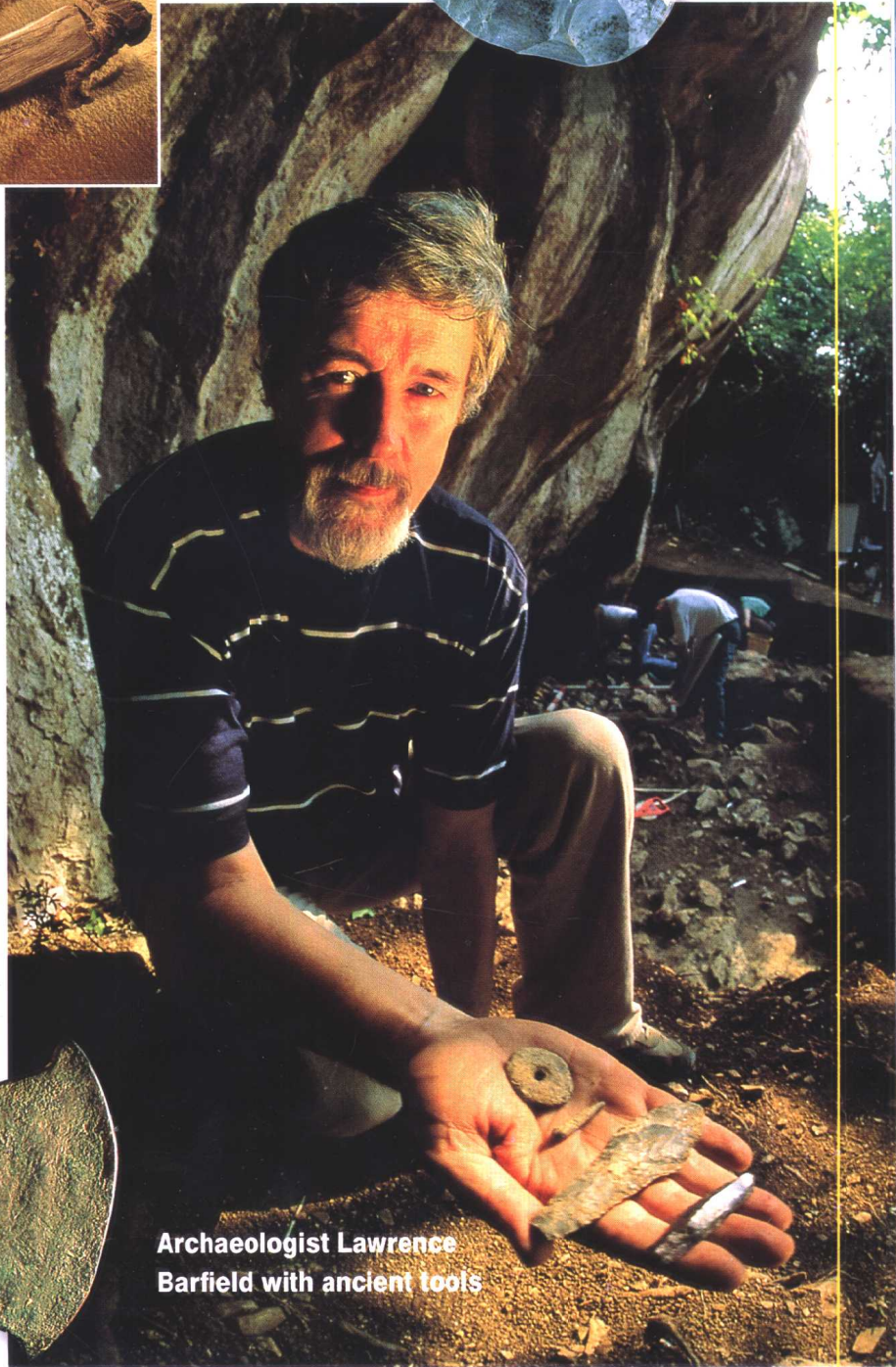
Ancient¹ stone-and-wood knife with a holder² made of woven³ grass



Ancient arrowhead⁴



Hand ax

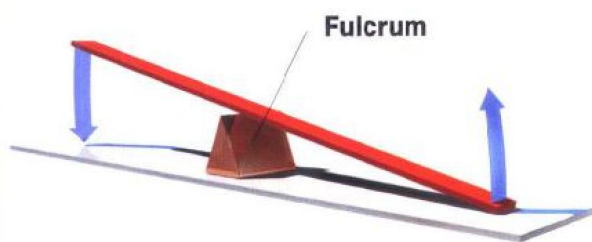


Archaeologist Lawrence Barfield with ancient tools

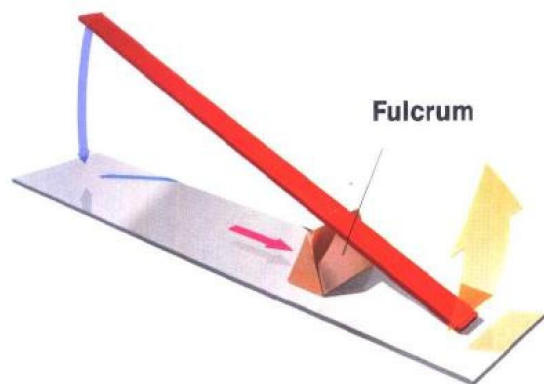
- | | | |
|--------------|-------------|---------|
| 1. ancient | <i>adj.</i> | 古代的。古老的 |
| 2. holder | <i>n.</i> | 套 |
| 3. weave | <i>v.</i> | 编织 |
| 4. arrowhead | <i>n.</i> | 箭头 |

Levers—Getting a Lift

The first machine actually invented by humans was probably the lever. All you need to make a lever is a long stick and something to balance¹ it on—called a fulcrum². When early humans wanted to move a heavy object like a large rock, they discovered they could use a tree limb³ and another rock as a fulcrum to lift the first rock. If they put the fulcrum at the middle of the limb, they could



With the fulcrum in the center, when you push down on one end of the lever, an equal force pushes up on the other end.



With the fulcrum closer to one end of the lever, when you push down on the longer end of the lever, a greater force pushes up on the shorter end.

change the direction of force. But they wouldn't gain any extra lifting power. By moving the fulcrum closer to the object they wanted to lift, they could use less force to lift the object.

The Inclined Plane—Ramping Up

A third type of machine is the inclined plane or ramp. An inclined plane, such as a board with one end raised, lets you move things up and down with ease⁴. Instead of lifting an object straight up, you can push the object up the inclined plane.

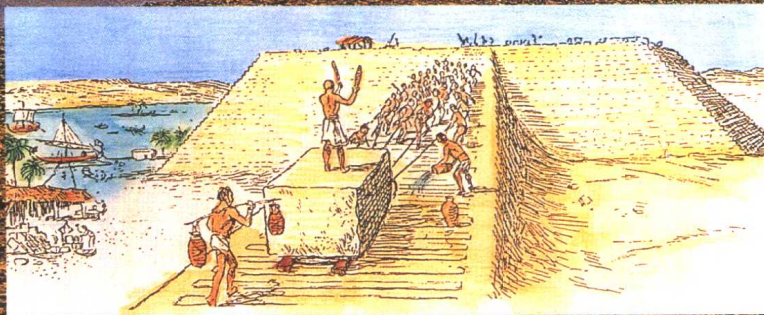
Ancient Egyptian⁵ engineers⁶ knew the value of an inclined plane. The Great Pyramid of Khufu⁷ in Giza⁸ is more than 450 feet high and made of huge limestone⁹ and granite¹⁰ blocks—some weighing about 50 tons. To get the blocks to the top of the pyramid the Egyptians used ramps, ropes, and a great deal of muscle¹¹ power. The ramps let workers drag or push the stones to higher and higher levels. Archaeologists believe that it would have taken 20,000 people about 20 years to complete the Great Pyramid.

- | | | |
|---------------------------|-------------|---------------------------|
| 1. balance | <i>n.</i> | 平衡 |
| 2. fulcrum | <i>n.</i> | 杠杆支点 |
| 3. limb | <i>n.</i> | 树枝 |
| 4. with ease | | 容易地 |
| 5. Egyptian | <i>adj.</i> | 埃及的 |
| 6. engineer | <i>n.</i> | 工程师 |
| 7. Great Pyramid of Khufu | | 胡夫大金字塔 |
| 8. Giza | | 吉萨(埃及北部城市, 金字塔和狮身人面像就在附近) |
| 9. limestone | <i>n.</i> | 石灰岩 |
| 10. granite | <i>n.</i> | 花岗岩 |
| 11. muscle | <i>n.</i> | 肌肉 |

Thinking Like a Scientist: Controlling Variables¹

When scientists do experiments², they control variables. A variable is something that could affect³ the outcome⁴ of the experiment. In an experiment, you want all of the variables to stay the same except the one that you are testing. Imagine trying to balance on a seesaw⁵ with a friend. If your friend stayed in one place while you moved toward the center, you would change one variable—your place on the board. If the seesaw moved, you'd know it was caused by your movement because all the other variables stayed the same.

1. variable	<i>n.</i>	变量
2. experiment	<i>n.</i>	实验
3. affect	<i>v.</i>	影响
4. outcome	<i>n.</i>	结果; 后果
5. seesaw	<i>n.</i>	跷跷板



Inclined planes were used to
build the pyramids.

Machines That Turn and Twist:

Turning the World Around

旋转的机器：转动世界

1. drill
2. supply

钻机
供应 补给

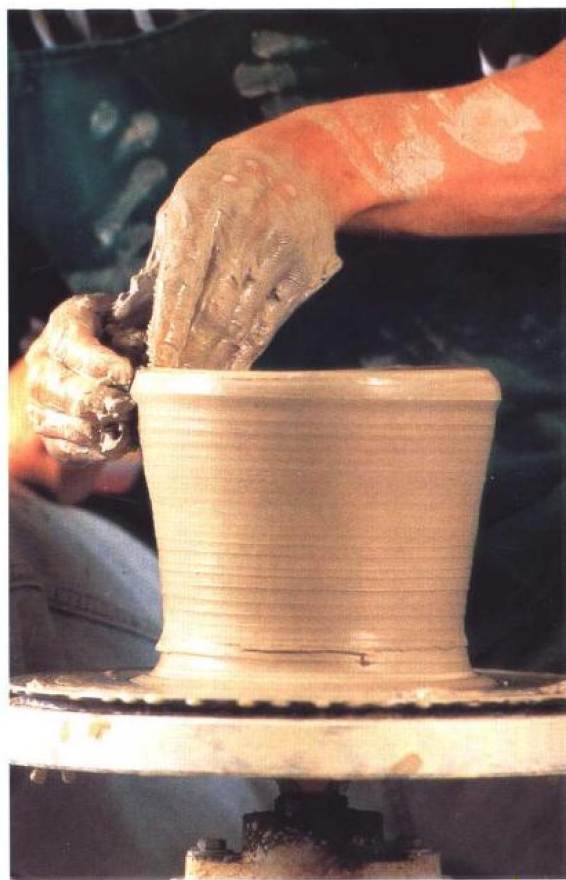
Drill' used to find underground oil and gas supplies?

Take a look around you. Do you see a wheel “hidden” in an object near you? Wheels are all around us making things spin¹, twist, and turn.

The Wheel and Axle—Going for a Spin

Think about a wheel on a bike. The wheel turns, but it stays fixed to the bike. That’s because in order for a wheel to spin around a certain point, it must have an axle. Without an axle, a wheel is not nearly² as useful.

Like levers and ramps, wheels were invented in ancient times. Archaeologists believe one of the first uses of the wheel was to make pottery³. In order to help shape clay⁴, potters⁵ used a device called a turntable⁶. The turntables had a flat wheel that spun sideways⁷ around an axle. The potters would start by putting clay on the top of the wheel. Then they would spin the wheel as they shaped the clay with their hands. The spinning wheel made it easier for the potters to make bowls and pots. Today many potters still use turntables that are similar⁸ to the ones used long ago.



A potter shaping clay on a turntable

- | | | |
|--------------|-------------|----------|
| 1. spin | <i>v.</i> | 旋转 |
| 2. nearly | <i>adv.</i> | 几乎；接近 |
| 3. pottery | <i>n.</i> | 陶器 |
| 4. clay | <i>n.</i> | 泥土；黏土 |
| 5. potter | <i>n.</i> | 陶工 |
| 6. turntable | <i>n.</i> | 转盘；转台 |
| 7. sideways | <i>adv.</i> | 向一侧地；从一边 |
| 8. similar | <i>adj.</i> | 相似的 |



An axle holds a wheel onto a car or bike but also lets the wheel spin.

For centuries wheels and axles have helped people move from place to place. Among the first vehicles¹ that moved people from one place to another were chariots². The chariots were like small wagons³ with only two wheels that were often pulled by horses. Each chariot had a small space for people to stand and was useful for soldiers in battle. Other wheeled vehicles were simple carts⁴ with a single wheel. Similar to a modern wheelbarrow⁵, they were used to transport⁶



- | | | |
|----------------|-----|----------|
| 1. vehicle | 车 | 车辆 |
| 2. chariot | 战车 | (古时)双轮战车 |
| 3. wagon | 四轮车 | 四轮运货马车 |
| 4. cart | 手推车 | 手推车 |
| 5. wheelbarrow | 手推车 | 手推车 |
| 6. transport | 运送 | 运送; 运输 |

Egyptian chariot